

We claim:

1       1. Apparatus for providing a web-accessible virtual  
2       processing environment to a network-connected office  
3       server for a remotely connected user computer through  
4       which a user stationed at the computer can execute any of  
5       a plurality of server-based applications resident at the  
6       office server, comprising:

7               a platform, capable of being situated in network  
8       communication between the user computer and the office  
9       server, having:

10               a processor;

11               a memory, connected to the processor and for  
12       storing computer executable instructions therein;

13               first and second network interfaces, operable  
14       in conjunction with the processor, for interfacing the  
15       platform, through the first network interface, to a wide  
16       area network (WAN) connection through which the remote  
17       user computer obtains connectivity to the platform, and,  
18       through the second network interface, to a local area  
19       network (LAN) having a server computer electrically  
20       communicative thereover, respectively, with the server  
21       computer forming the office server; and

22               wherein, in response to the executable  
23       instructions, the processor, for each one of the  
24       server-based applications:

25               provides, through a corresponding client  
26       application module implemented on the platform for each  
27       of the server-based applications, bi-directional protocol

28 conversion of messages between the remote user computer  
29 and the office server, such that user interaction data,  
30 intended for a specific one of the server-based  
31 applications and provided by a browser executing on the  
32 remote user computer in a first protocol, is converted  
33 into a second protocol associated with said one  
34 server-based application and then applied to the  
35 server-based application at the office server, and output  
36 data, provided by said specific one server-based  
37 application, is converted from the second protocol to the  
38 first protocol for being transmitted to the user computer  
39 and graphically rendered thereat, through the browser, to  
40 the user.

1 2. The apparatus in claim 1 wherein the processor, in  
2 response to execution of the stored instructions:  
3       for messages emanating from the user computer and  
4 appearing on the WAN connection:  
5           receives, from the browser, a first message  
6 containing the user interaction data associated with a  
7 specific one server-based application and in the first  
8 protocol;  
9           converts the user interaction data in the first  
10 protocol to the second protocol associated with the  
11 specific one server-based application to yield a second  
12 message; and  
13           applies the second message, as input, to the  
14 server computer for processing by the specific one  
15 server-based application; and

16                   for messages emanating from the server computer and  
17                   appearing on the LAN:

18                   receives, from the server computer and over the  
19                   LAN connection, a third message containing output data  
20                   generated by the specific one server-based application  
21                   and in the second protocol;

22                   converts the output data message in the second  
23                   protocol to the first protocol to yield a fourth message;  
24                   and

25                   applies the fourth message to the WAN  
26                   connection for transmission to the browser in order to  
27                   render the output data thereat.

1       3. The apparatus in claim 2 wherein the server computer  
2                   comprises a corresponding server for each of the  
3                   server-based applications and is implemented either  
4                   coincident with the platform or as at least one physical  
5                   computer separate from the platform and connected, via  
6                   the LAN, to it.

1       4. The apparatus in claim 3 further comprising, in the  
2                   platform, a separate corresponding software-implemented  
3                   application module for each of the specific server-based  
4                   applications for providing protocol translation of the  
5                   user interaction data and output data between the first  
6                   and second protocols; the application module comprises:

7                   a user interaction component communicative, through  
8                   the WAN connection, with the browser, for accepting the  
9                   user interaction data from the browser in the first

10 protocol and for providing said output data to the  
11 browser in the first protocol;  
12 a state machine, communicative through an  
13 application processing interface with the user  
14 interaction component, for interpreting each command  
15 issued by the user interaction component so as to provide  
16 the user interaction data to the specific one  
17 server-based application executing on the server  
18 computer, and communicative through a client protocol  
19 component, for sending user interaction data to the  
20 server-based application and for receiving said output  
21 information from the specific one server-based  
22 application; and  
23 a client protocol component, operative in  
24 conjunction with the state machine, for converting the  
25 user interaction data received from the state machine  
26 into the second protocol and applying resultant messages  
27 in the second protocol to the specific one server-based  
28 application, and for receiving said output data in the  
29 second protocol from the specific one server-based  
30 application and applying said output data to the state  
31 machine.

1 5. The apparatus in claim 4 wherein the server-based  
2 applications comprise thin-client application hosting,  
3 e-mail and shared file access; and the first protocol  
4 comprises HTTP, secure HTTP, or a protocol with AIP-like  
5 functionality and the second protocol comprises RDP

6 (remote desktop protocol), IMAP (Internet mail access  
7 protocol) or SMB (server message block).

1 6. The apparatus in claim 5 wherein the user  
2 interaction data comprises a designation of a uniform  
3 resource locator (URL), uniform resource identifier  
4 (URI), form input, keystrokes or mouse clicks that  
5 returns associated information desired by the user, and  
6 output data comprises graphical display data.

1 7. The apparatus in claim 6 wherein said output data  
2 comprises bitmap graphic output display data generated by  
3 the specific one server-based application.

1 8. The apparatus in claim 7 wherein the WAN connection  
2 comprises either a private network connection or an  
3 Internet connection.

1 9. The apparatus in claim 8 wherein the second network  
2 interface comprises an Ethernet interface, and the first  
3 network interface comprises a broadband network  
4 interface.

1 10. The apparatus in claim 9 wherein the broadband  
2 network interface comprises a digital subscriber line  
3 (DSL) interface, a cable modem, an integrated services  
4 digital network (ISDN) interface, a T1 interface or a  
5 fractional T1 interface.

1       11. A method for use, in apparatus, which provides for  
2       providing a web-accessible virtual processing environment  
3       to a network-connected office server for a remotely  
4       connected user computer through which a user stationed at  
5       the computer can execute any of a plurality of  
6       server-based applications resident at the office server,  
7       the apparatus comprising a platform, capable of being  
8       situated in network communication between the user  
9       computer and the office server, having: a processor, a  
10      memory, connected to the processor and for storing  
11      computer executable instructions therein; first and  
12      second network interfaces, operable in conjunction with  
13      the processor, for interfacing the platform, through the  
14      first network interface, to a wide area network (WAN)  
15      connection through which the remote user computer obtains  
16      connectivity to the platform, and, through the second  
17      network interface, to a local area network (LAN) having a  
18      server computer electrically communicative thereover,  
19      respectively, with the server computer forming the office  
20      server; wherein, the method comprises the steps,  
21      performed by the processor, for each one of the  
22      server-based applications:  
23               providing, through a corresponding client  
24           application module implemented on the platform for each  
25           of the server-based applications, bi-directional protocol  
26           conversion of messages between the remote user computer  
27           and the office server, wherein the providing step  
28           comprises the steps of:

23               providing, through a corresponding client  
24           application module implemented on the platform for each  
25           of the server-based applications, bi-directional protocol  
26           conversion of messages between the remote user computer  
27           and the office server, wherein the providing step  
28           comprises the steps of:

29                   converting user interaction data, intended for  
30    a specific one of the server-based applications and  
31    provided by a browser executing on the remote user  
32    computer from a first protocol into a second protocol  
33    associated with said one server-based application so as  
34    to yield converted user interaction data;

35                   applying the converted user interaction data to  
36    the server-based application at the office server;

37                   converting output data, provided by said  
38    specific one server-based application, from the second  
39    protocol to the first protocol so as to yield converted  
40    output data; and

41                   transmitting the converted output data to the  
42    user computer to be graphically rendered thereat, through  
43    the browser, to the user.

1    12. The method in claim 11 further comprising the steps  
2    of:

3                   for messages emanating from the user computer and  
4    appearing on the WAN connection:

5                   receiving, from the browser, a first message  
6    containing the user interaction data associated with a  
7    specific one server-based application and in the first  
8    protocol;

9                   converting the user interaction data in the  
10   first protocol to the second protocol associated with the  
11   specific one server-based application to yield a second  
12   message; and

13                   applying the second message, as input, to the  
14   server computer for processing by the specific one  
15   server-based application; and

16                   for messages emanating from the server computer and  
17   appearing on the LAN:

18                   receiving, from the server computer and over  
19   the LAN connection, a third message containing output  
20   data generated by the specific one server-based  
21   application and in the second protocol;

22                   converting the output data message in the  
23   second protocol to the first protocol to yield a fourth  
24   message; and

25                   applying the fourth message to the WAN  
26   connection for transmission to the browser in order to  
27   render the output data thereat.

1   13. The method in claim 12 further comprising the SEP of  
2   implementing a corresponding server for each of the  
3   server-based applications either coincident with the  
4   platform or as at least one physical computer separate  
5   from the platform and connected, via the LAN, to it.

1   14. The method in claim 13 further comprising the step  
2   of providing protocol translation of the user interaction  
3   data and output data between the first and second  
4   protocols through a separate software-implemented  
5   application module for each of the specific server-based  
6   applications; wherein the application module comprises:

7           a user interaction component communicative, through  
8   the WAN connection, with the browser, for accepting the  
9   user interaction data from the browser in the first  
10   protocol and for providing said output data to the  
11   browser in the first protocol;

12           a state machine, communicative through an  
13   application processing interface with the user  
14   interaction component, for interpreting each command  
15   issued by the user interaction component so as to provide  
16   the user interaction data to the specific one  
17   server-based application executing on the server  
18   computer, and communicative through a client protocol  
19   component, for sending user interaction data to the  
20   server-based application and for receiving said output  
21   information from the specific one server-based  
22   application; and

23           a client protocol component, operative in  
24   conjunction with the state machine, for converting the  
25   user interaction data received from the state machine  
26   into the second protocol and applying resultant messages  
27   in the second protocol to the specific one server-based  
28   application, and for receiving said output data in the  
29   second protocol from the specific one server-based  
30   application and applying said output data to the state  
31   machine.

1       15. The method in claim 14 wherein the server-based  
2   applications comprise thin-client application hosting,  
3   e-mail and shared file access; and the first protocol

4 comprises HTTP, secure HTTP, or a protocol with AIP-like  
5 functionality and the second protocol comprises RDP  
6 (remote desktop protocol), IMAP (Internet mail access  
7 protocol) or SMB (server message block).

1 16. The method in claim 15 wherein the user interaction  
2 data comprises a designation of a uniform resource  
3 locator (URL), uniform resource identifier (URI), form  
4 input data, user keystrokes or user mouse clicks that  
5 returns associated information desired by the user, and  
6 the output data comprises graphical display data.

1 17. The method in claim 16 wherein said output data  
2 comprises bitmap graphic output display data generated by  
3 the specific one server-based application.

1 18. The method in claim 17 wherein the WAN connection  
2 comprises either a private network connection or an  
3 Internet connection.

1 19. The method in claim 18 wherein the second network  
2 interface comprises an Ethernet interface, and the first  
3 network interface comprises a broadband network  
4 interface.

1 20. The method in claim 19 wherein the broadband network  
2 interface comprises a digital subscriber line (DSL)  
3 interface, a cable modem, an integrated services digital

4 network (ISDN) interface, a T1 interface or a fractional  
5 T1 interface.